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THE COMMISSIONER FOR PATENTS, Washington, D.C. 20231

Enclosed for filing is the patent application of Inventor(s):
STEFAN MARGHUERITE JEAN WILLEMS

For: SYSTEM FOR GENERATING SOUND

ENCLOSED ARE:

- Appointment of Associates;
- Information Disclosure Statement, Form PTO-1449 and copies of documents listed therein;
- Preliminary Amendment;
- Specification (8 Pages of Specification, Claims, & Abstract);
- Declaration and Power of Attorney:
(1 Page of a []fully executed unsigned Declaration);
- Drawing (2 sheets of []informal formal sheets);
- Certified copy of a EUROPEAN application Serial No.00202984.1;
- Authorization Pursuant to 37 CFR §1.136(a)(3)
- Other: ;
- Assignment to

FEE COMPUTATION

CLAIMS AS FILED				
FOR	NUMBER FILED	NUMBER EXTRA	RATE	BASIC FEE - \$710.00
Total Claims	7 - 20 = 0		X \$18 =	0.00
Independent Claims	1 - 3 = 0		X \$80 =	0.00
Multiple Dependent Claims, if any			\$270 =	0.00
TOTAL FILING FEE			=	\$710.00

Please charge Deposit Account No. 14-1270 in the amount of the total filing fee indicated above, plus any deficiencies. The Commissioner is also hereby authorized to charge any other fees which may be required, except the issue fee, or credit any overpayment to Account No. 14-1270.

[] Amend the specification by inserting before the first line as a centered heading --Cross Reference to Related Applications--; and insert below that as a new paragraph --This is a continuation-in-part of application Serial No. filed, which is herein incorporated by reference--.

CERTIFICATE OF EXPRESS MAILING

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Date of Deposit (August 27, 2001)

I hereby certify that the paper and/or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. 1.10 on the date indicated above and is addressed to the Commissioner of Patents and Trademarks, Washington, D.C. 20231.

Natalie A. Manzo
Typed Name

Signature

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J109/96045
08/27/01

Barcode

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

YVES RAMANZIN

FR 000079

Serial No.

Group Art Unit

Filed: CONCURRENTLY

Ex.

Title: DATA TRANSMISSION SYSTEM, EQUIPMENT SUITABLE FOR SUCH A
SYSTEM AND DATA TRANSMISSION METHOD

Commissioner for Patents

Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to calculation of the filing fee and examination, please
amend the above-identified application as follows:

IN THE CLAIMS

Please amend claims 3, 4, 6 and 7 follows:

1 3. (Amended) A system as claimed in claim 1, characterized in
2 that the virtual filter comprises a second sixth-order filter (52,
3 53) for signals which are transported from one audio channel to the
4 other.

1 4. (Amended) A system as claimed in claim 1, characterized in
2 that a signal of a spatial rear channel is added to the signal of
3 an audio channel.

1 6. (Amended) A system as claimed in claim 4, characterized in
2 that the signal is conducted through a delay circuit (27, 28).

1 7. (Amended) A system as claimed in claim 4, characterized in
2 that the signal is conducted through a reverberation circuit.

REMARKS

The foregoing amendment to claims 3, 4, 6 and 7 were made solely to avoid filing the claims in the multiple dependent form so as to avoid the additional filing fee.

The claims were not amended in order to address issues of patentability and Applicant respectfully reserves all rights under the Doctrine of Equivalents. Applicant furthermore reserves the right to reintroduce subject matter deleted herein at a later time during the prosecution of this application or continuing applications.

Respectfully submitted,

By 
Jack D. Slobod, Reg. No. 26,236
Attorney
(914) 333-9606
August 27, 2001

Appendix A

Version with Markings
to Show Changes Made to the Claim
The following are marked up versions of amended claims 3, 4, 6
and 7:

1 3. (Amended) A system as claimed in claim 1 ~~and/or~~ 2,
2 characterized in that the virtual filter comprises a second sixth-
3 order filter (52, 53) for signals which are transported from one
4 audio channel to the other.

1 4. (Amended) A system as claimed in claim 1 ~~one or several of~~
2 ~~the preceding claims 1 to 3,~~ characterized in that a signal of a
3 spatial rear channel is added to the signal of an audio channel.

1 6. (Amended) A system as claimed in claim 4 ~~or~~ 5, characterized
2 in that the signal is conducted through a delay circuit (27, 28).

1 7. (Amended) A system as claimed in claim 4 ~~or~~ 5, characterized
2 in that the signal is conducted through a reverberation circuit.

202500-0000017

System for generating sounds

The invention relates to a system for generating sounds with a left front loudspeaker which converts an electric signal of a left audio channel and with a right front loudspeaker which converts an electric signal of a right audio channel, as defined in the preamble of claim 1.

5

Such a system for generating sounds in a room is known from WO 99/41947. The electric signals are processed such that spatial rear loudspeakers are dispensed with and the front loudspeakers generate a surround or spatial sound.

10

The invention has for its object to improve a surround sound for a listener.

15

This object is achieved by means of the characteristics of claim 1. According to the invention, a virtual filter generates virtual sound bodies laterally of a listener in a region between 80 and 100 degrees, preferably between 85 and 95 degrees, more in particular at 90 degrees. Research has shown that the human ear is most sensitive to surrounding sound when sound sources are arranged laterally of a listener's head or when spatial sound is generated laterally of a listener. Since the front loudspeakers are usually positioned close to audio or video devices and are accordingly in front of the listener, two virtual sound bodies are advantageously generated laterally of the listener's head, one virtual sound body for each

20

of the two human ears.

25

In a simple manner, the filter comprises a sixth-order filter with an infinite pulse response. The sixth-order filter generates a spatial sound at approximately 90 degrees laterally of the head of a listener. For this purpose, the electric signal of an audio channel is applied to the filter, and the pulse response is added to the electric signal of the audio channel again by means of an adder. Two mutually independent sixth-order filters are provided for the signals of the two audio channels.

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Advantageously, the virtual filter comprises a second sixth-order filter for signals which are transported from one audio channel to the other. The spatial sound impression is enhanced thereby. The second filter operates with coefficients which are different from the coefficients of the first sixth-order filter.

5 Advantageously, a signal of the corresponding spatial rear channel is added to the signal of an audio channel before it is applied to the filters. The signal of the left rear spatial channel is thus added to the signal of the left audio channel, and the signal of the right rear spatial channel is added to the signal of the right audio channel. The spatial sound impression is enhanced thereby.

10 Advantageously, the signal of the rear spatial channel is low-pass filtered before it is added to the signal of the audio channel. This means that only low frequencies, and no high frequencies, are added to the signal of the audio channel. The lower a frequency, the more difficult it is to determine its origin.

15 Advantageously, the signal of the rear spatial channel is passed through a delay circuit before it is added to the signal of the audio channel. A reverberation or an echo effect is achieved thereby.

An advantageous alternative is that the signal is directly supplied through a reverberation circuit.

20 For a better understanding of the invention, an embodiment will be explained in more detail below with reference to the drawing, in which

Fig. 1 shows five loudspeakers arranged around a listener's head,

Fig. 2 shows a mixer for generating a spatial sound, and

Fig. 3 shows a virtual filter for generating a virtual loudspeaker shifted

25 through 90 degrees.

Fig. 1 shows a listener 1 whose head 2 is surrounded by five real loudspeakers 3, 4, 5, 6, and 7. The left front loudspeaker 3 converts an electric signal of a left audio channel. The right front loudspeaker 4 converts an electric signal of a right audio channel.

30 The left rear surround loudspeaker 5 converts an electric signal of a left rear surround channel, and the right rear surround loudspeaker 6 converts an electric signal of a right rear surround channel. A further, central loudspeaker 7 reproduces an electric signal of a central audio channel. All these five loudspeakers are arranged at an average height which corresponds to the height of the ears of the listener 1. Sound waves and a spatial sound are

generated by means of the real loudspeakers 3 and 4 in a manner as though virtual loudspeakers 9 and 10 were present around the listener 1. The listener 1 faces the central loudspeaker, thus defining a viewing direction 11. The front loudspeakers 3 and 4 are positioned at +30 and -30 degrees with respect to this viewing direction, the rear surround 5 loudspeakers 5 and 6 at +110 and -110 degrees.

Fig. 2 shows a mixer 15 which is connected between four electrically conducting lines 16, 17, 18, and 19 for four audio channels and further lines 20 and 21 for audio channels which control a loudspeaker for low frequencies and the centrally arranged 10 loudspeaker 7. The mixer 15 has a three-stage construction with a first mixer stage 22, a second mixer stage 23, and a third mixer stage 24. The first mixer stage 22 comprises a low-pass filter 25 and a second low-pass filter 26 as well as a first delay circuit 27 and a second delay circuit 28. Alternatively, reverberation units may be provided instead of the delay 15 circuits 27, 28. The second stage 23 comprises two adders 29 and 30. The third mixer stage is formed by a virtual filter 31 and two further adders 32 and 33. The electric signal of the left 20 audio channel on the line 16 is supplied to the virtual filter 31 through further lines 34 and 35. The electric signal of the right audio channel on the line 17 is also supplied to the virtual filter 31 through further lines 36 and 37. The signals of the left and right audio channels are processed in the virtual filter 31 such that the respective front loudspeakers 3 and 4 generate 25 sounds as though sound bodies were positioned laterally of the listener in a region between 80 and 100 degrees, preferably between 85 and 95 degrees, in particular at 90 degrees. These sound bodies or sound sources are the virtual loudspeakers 9 and 10. The electric signals thus processed are mixed with the electric signals of the left and right audio channels on the lines 16 and 17 again via the two adders 32 and 33. The signal of the rear left surround channel on 30 the line 18 and the signal of the rear right surround channel on the line 19 are derived from these lines 18 and 19 and are supplied to the two low-pass filters 25 and 26 through further lines 38 and 39. High frequencies of above 2500 Hz are filtered out in the low-pass filters 25 and 26, the frequency being limited by 6 dB per octave starting from 2500 Hz. Each signal is individually transported from the low-pass filters 25 and 26 to the respective delay circuits 27 and 28. The electric signal is delayed there. From the delay circuits 27 and 28 the signals thus processed are supplied to the adders 29 and 30 via connecting lines 40 and 41 and are mixed with the signals coming from the left and right audio channels. The signal of the left audio channel is mixed with the signal of the rear left surround channel, and the signal of the right audio channel is mixed with the signal of the rear right surround channel. The adders 29 and 33

30 are adjustable and are capable of adding or mixing the signals in adjustable mixing ratios. Subsequently, the electric signal of the left audio channel, which now comprises components of the signal from the rear left surround channel, reaches the virtual filter 31. Similarly, the signal of the right audio channel 17, which has now been mixed with the signal of the right 5 surround channel, reaches the virtual filter 31. From the virtual filter 31, the processed signals reach the adders 32 and 33 via output lines 42 and 43.

Fig. 3 shows the virtual filter 31, which comprises four filters 50, 51, 52, and 53 of the sixth order, two further delay circuits 54 and 55, and two further adders 56 and 57.

10 The filters 50 and 51 are different from the filters 52 and 53. Such filters are explained in detail in the book "Digitale Signaalbewerking" (Digital Signal Processing) by Ir. A.W.M. van den Enden and Ir. N.A.M. Verhoecks, ISBN no. 90 6674 7226, Delta Press B.V., on page 204, section 7.31 entitled "De directe vorm I" (The direct shape I). The signal mixed by the adder 29 from the signals of the left audio channel and the left rear surround channel reaches a first 15 sixth-order filter 50 via the line 35 and is passed on from there through a further connecting line 58 and the adder 56 to the output line 42. The signal of the right audio channel and the right rear surround channel, mixed in the adder 30, is passed on to a second sixth-order filter 51 via the line 37 and reaches the output line 43 via a further connecting line 59 and the adder 57. The signal mixed in the adder 29, furthermore, is mixed with the signal on the line 20 59 via the sixth-order filter 52, the delay circuit 54, and the adder 57. Similarly, the signal mixed in the adder 30 is mixed with the signal on the connecting line 58 by means of the adder 56 via the filter 53 and the delay circuit 55 and is supplied to the output line 42. The signals of the left and right audio channels are mixed with one another crosswise via the filters 52 and 53.

25

If digital signals are transmitted, an addition implies a simple summation of two values. All adders are adjustable and are capable of adding the incoming signals in adjustable ratios to one another.

TOP SECRET
CLASSIFIED
CONFIDENTIAL
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List of reference numerals

1	listener
2	head
3	left front loudspeaker
5	right front loudspeaker
4	left surround loudspeaker
6	right surround loudspeaker
7	central loudspeaker
8	central plane
10	left virtual loudspeaker
9	right virtual loudspeaker
11	viewing direction
12	
13	
15	mixer
14	
15	line for left audio channel
16	line for right audio channel
17	line for rear left surround channel
18	line for rear right surround channel
20	line for central loudspeaker
19	audio channel for base loudspeaker
21	first mixer stage
22	second mixer stage
23	third mixer stage
25	low-pass filter
26	low-pass filter
27	delay circuit
28	delay circuit
30	adder
29	adder
31	virtual filter
32	adder

33	adder
34	line
35	line
36	line
5 37	line
38	line
39	line
40	connecting line
41	connecting line
10 42	output line
43	output line
15 50	first sixth-order filter
51	first sixth-order filter
52	first sixth-order filter
53	first sixth-order filter
54	delay circuit
55	delay circuit
56	adder
20 57	adder
58	connecting line
59	connecting line

CLAIMS:

1. A system for generating sounds with a left front loudspeaker (3) which converts an electric signal of a left audio channel and with a right front loudspeaker (4) which converts an electric signal of a right audio channel, characterized in that a virtual filter (31) generates virtual sound bodies (9, 10) laterally of a listener (1) in a region between 80 and 5 100 degrees, preferably between 85 and 95 degrees, more in particular at 90 degrees.
2. A system as claimed in claim 1, characterized in that the virtual filter (31) comprises a sixth-order filter (50, 51) for the signals of each audio channel.
- 10 3. A system as claimed in claim 1 and/or 2, characterized in that the virtual filter comprises a second sixth-order filter (52, 53) for signals which are transported from one audio channel to the other.
- 15 4. A system as claimed in one or several of the preceding claims 1 to 3, characterized in that a signal of a spatial rear channel is added to the signal of an audio channel.
5. A system as claimed in claim 4, characterized in that the signal of the rear surround channel is conducted through a low-pass filter (25, 26).
- 20 6. A system as claimed in claim 4 or 5, characterized in that the signal is conducted through a delay circuit (27, 28).
7. A system as claimed in claim 4 or 5, characterized in that the signal is conducted through a reverberation circuit.

ABSTRACT:

The invention relates to a system for generating sounds with a left front loudspeaker which converts an electric signal of a left audio channel and with a right front loudspeaker which converts an electric signal of a right audio channel. Such a system for generating sounds in a room is known. The electric signals are processed such that spatial rear loudspeakers are dispensed with and the front loudspeakers generate a surround or spatial sound. According to the invention, a virtual filter generates virtual sound bodies laterally of a listener in a region between 80 and 100 degrees. Experiments have shown that the human ear is most sensitive to surrounding sound when sound sources are arranged laterally of a listener's head or when spatial sound is generated laterally of a listener.

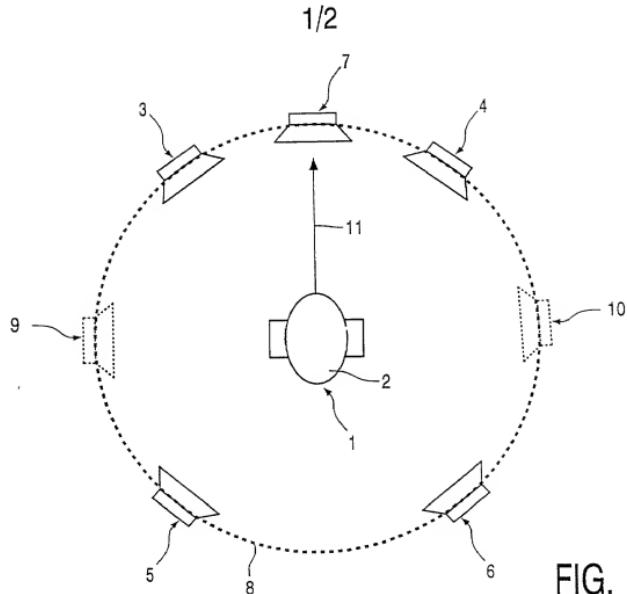


FIG. 1

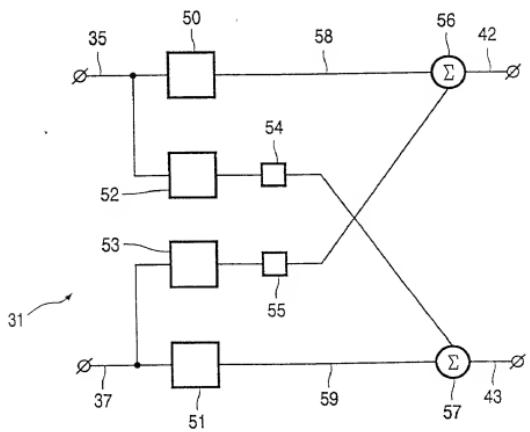


FIG. 3

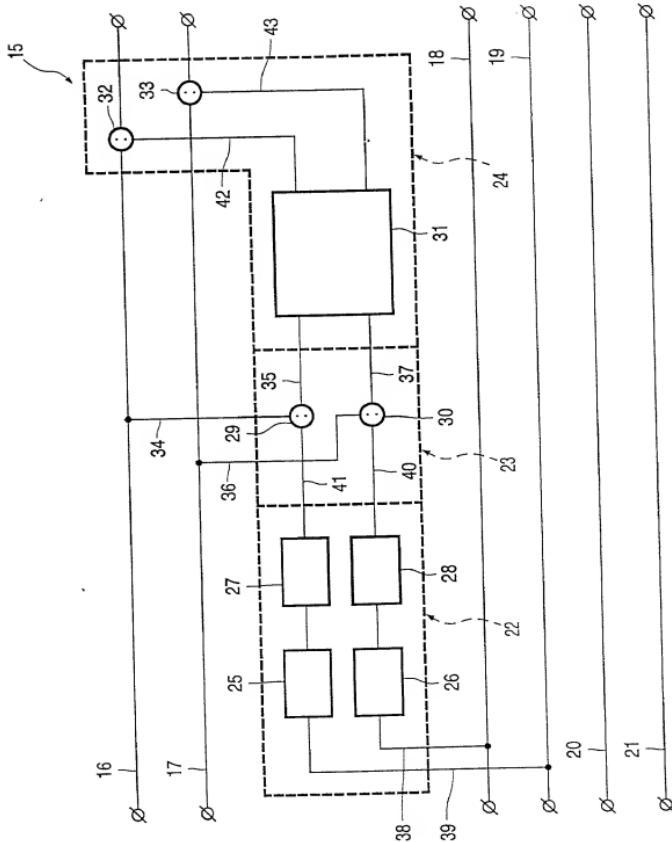


FIG. 2

DECLARATION and POWER OF ATTORNEY

ATTORNEY'S DOCKET NO.:
PHBE000017

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

"System for generating sounds"

the specification of which (check one)

is attached hereto.

was filed on _____

as Application Serial No. _____

and was amended on _____

(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by the amendment(s) referred to above.

I acknowledge the duty to disclose information which is material to patentability of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I hereby claim foreign priority benefits under Title 35, United States Code, § 119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)

COUNTRY	APP. NUMBER	DATE OF FILING (DATE, MONTH, YEAR)	PRIORITY CLAIMED UNDER 35 U.S.C. 119
Europe	00202984.1	28 August 2000	YES

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35 United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

PRIOR UNITED STATES APPLICATION(S)

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (PATENTED, PENDING, ABANDONED)
1		
2		
3		

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. (list name and registration number)

Jack E. Haken, Reg. No. 26,902

Michael E. Marion, Reg. No. 32,266

Edward M. Blocker, Reg. No. 30,245

SEND CORRESPONDENCE TO: Corporate Patent Counsel, U.S. Philips Corporation; 580 White Plains Road; Tarrytown, NY 10591	DIRECT TELEPHONE CALLS TO: (name and telephone No.) (914) 332-0222
--	--

Dated:

Inventor's Signature:

Full Name of Inventor	Last Name WILLEMS	First Name Stefan	Middle Name Marguerite Jean
Residence & Citizenship	City Leuven	State or Foreign Country Belgium	Country of Citizenship Belgium
Post Office Address	Street Interleuvenlaan 74-76	City B-3001 Leuven	State or Country Belgium Zip Code

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of

Atty. Docket

STEFAN M.J. WILLEMS

BE 000017

Serial No.

Group Art Unit

Filed: CONCURRENTLY

Ex.

Title: SYSTEM FOR GENERATING SOUNDS

Commissioner for Patents
Washington, D.C. 20231

APPOINTMENT OF ASSOCIATES

Sir:

The undersigned Attorney of Record hereby revokes all prior appointments (if any) of Associate Attorney(s) or Agent(s) in the above-captioned case and appoints:

JACK D. SLOBOD

(Registration No. 26,236)

c/o U.S. PHILIPS CORPORATION, Intellectual Property Department, 580 White Plains Road, Tarrytown, New York 10591, his Associate Attorney(s)/Agent(s) with all the usual powers to prosecute the above-identified application and any division or continuation thereof, to make alterations and amendments therein, and to transact all business in the Patent and Trademark Office connected therewith.

ALL CORRESPONDENCE CONCERNING THIS APPLICATION AND THE LETTERS PATENT WHEN GRANTED SHOULD BE ADDRESSED TO THE UNDERSIGNED ATTORNEY OF RECORD.

Respectfully,


Michael E. Marion, Reg. 32,266
Attorney of Record

Dated at Tarrytown, New York
this 27th day of August, 2001.
\\SERVER0\\SYS2\\WPDOCS\\SL\\BE000017appasoc.doc